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GB 1446684
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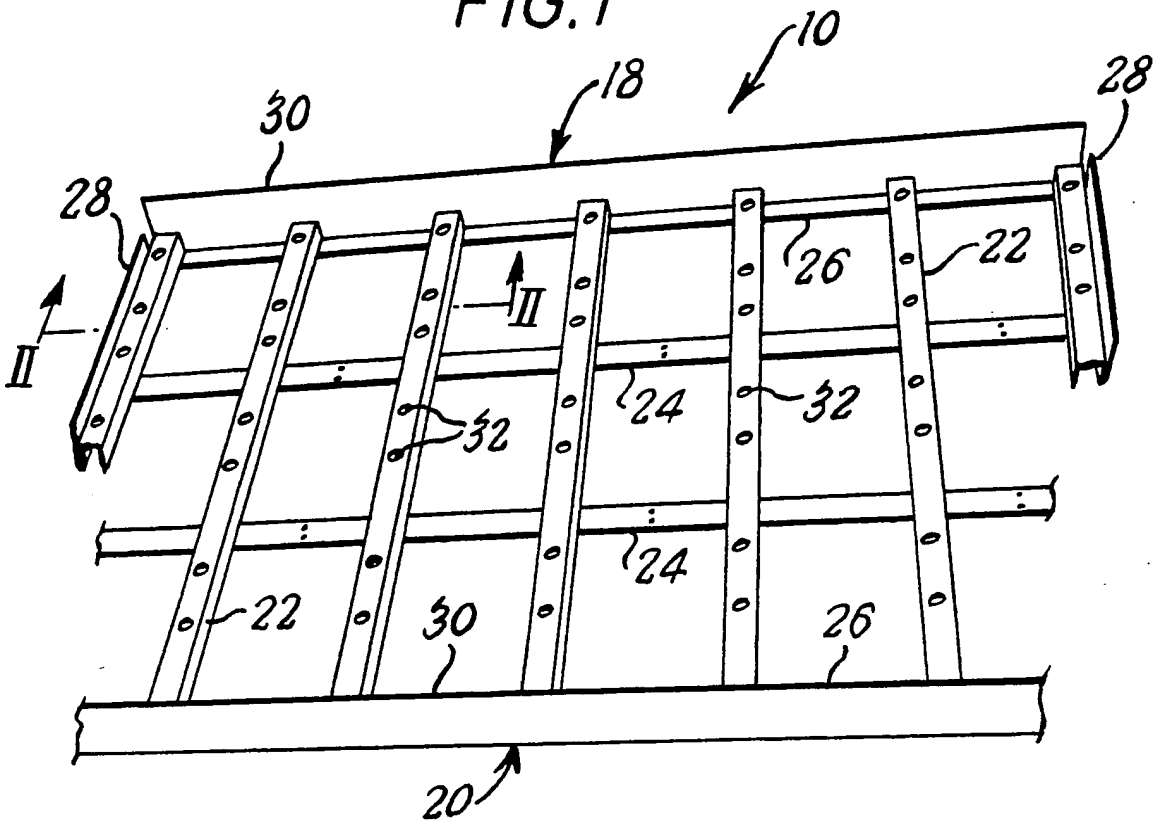
(54) **Screens**

(57) A screen for separating and grading according to particle size has a series of modular screen mat elements mounted thereon and secured by expandible fasteners. The elements are mounted in edge-to-edge relationship in a staggered configuration so that screening zones between adjacent screen mats overlap each other in the intended direction of flow of particulate material over the screen. The staggered relationship between the mat elements may be achieved between adjacent rows of elements by each mat being formed from a standard modular size which is divided to provide a half element in a row.

Preferably the mat elements have ribs by which they sit on supporting members of the support frame and are secured by fasteners through the ribs. The support frame may be rectangular having edge members and an array of frame members extending between the edge members on which frame members the mat elements sit for support.

GB 2 092 917 A

FIG. 1



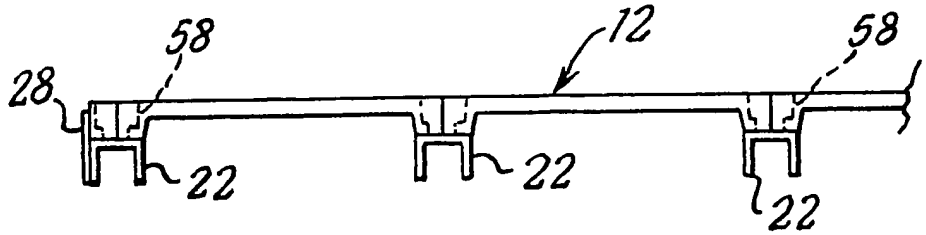
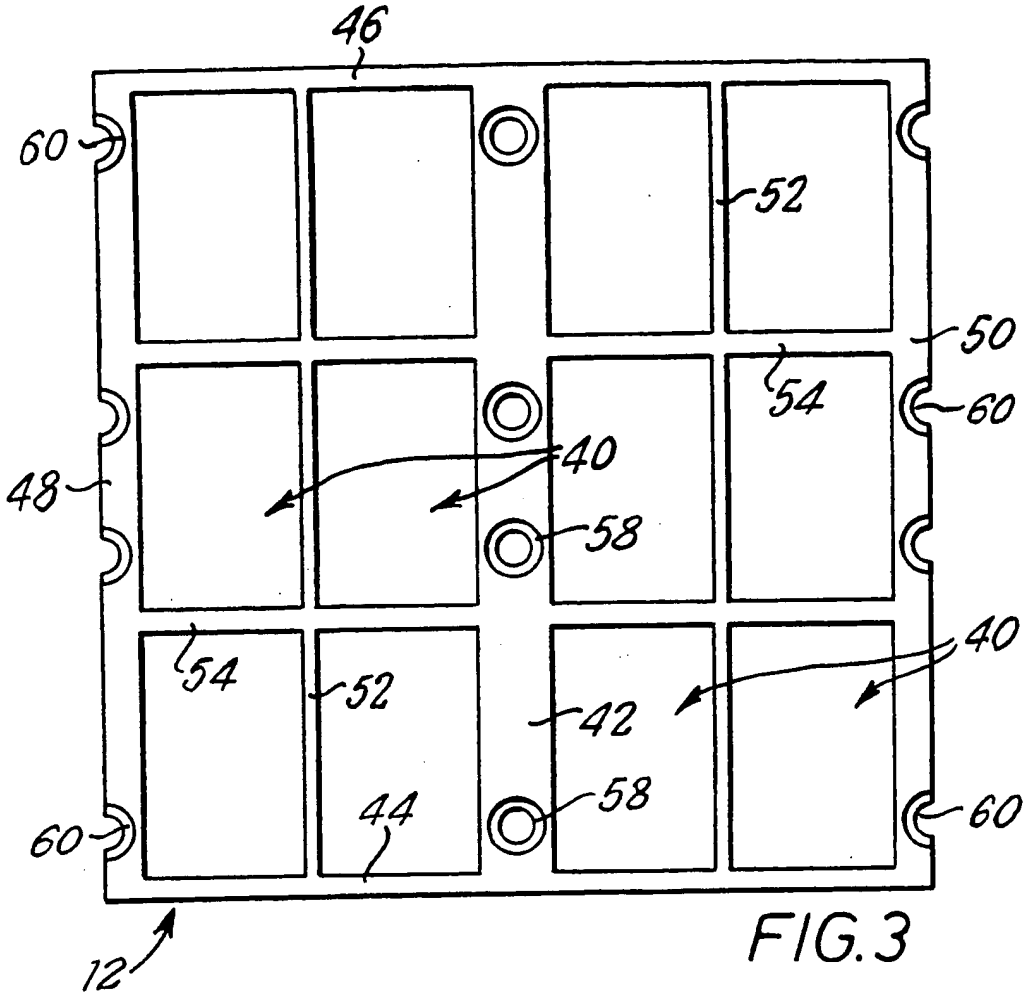




FIG. 2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44
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60
12

FIG. 3

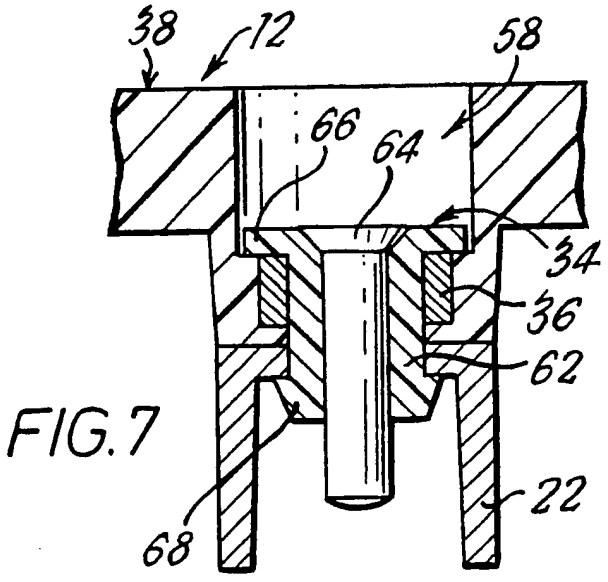
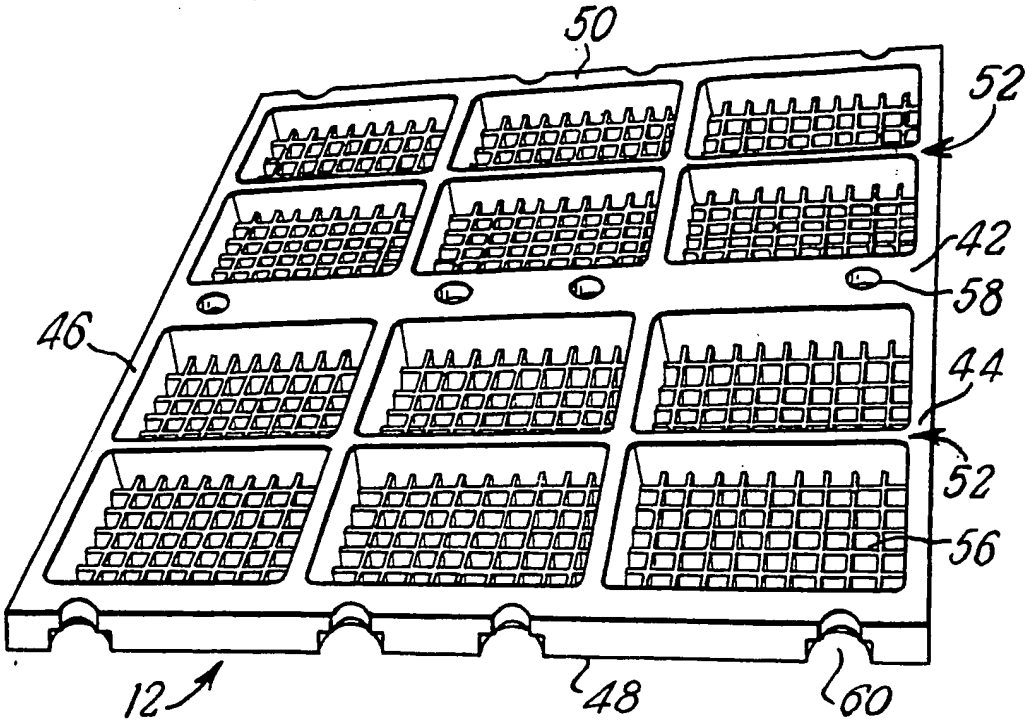

38
12
58
66
64
34
36
62
68
22

FIG. 7

FIG. 4



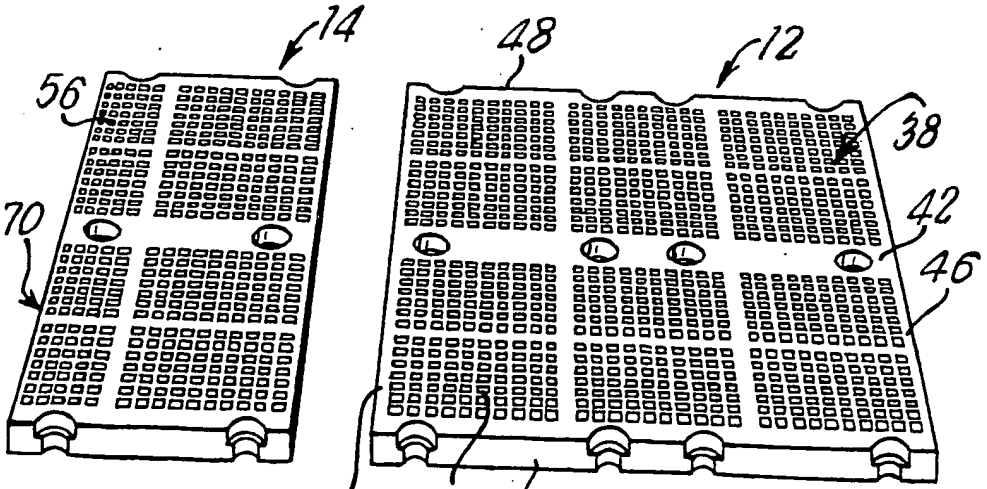
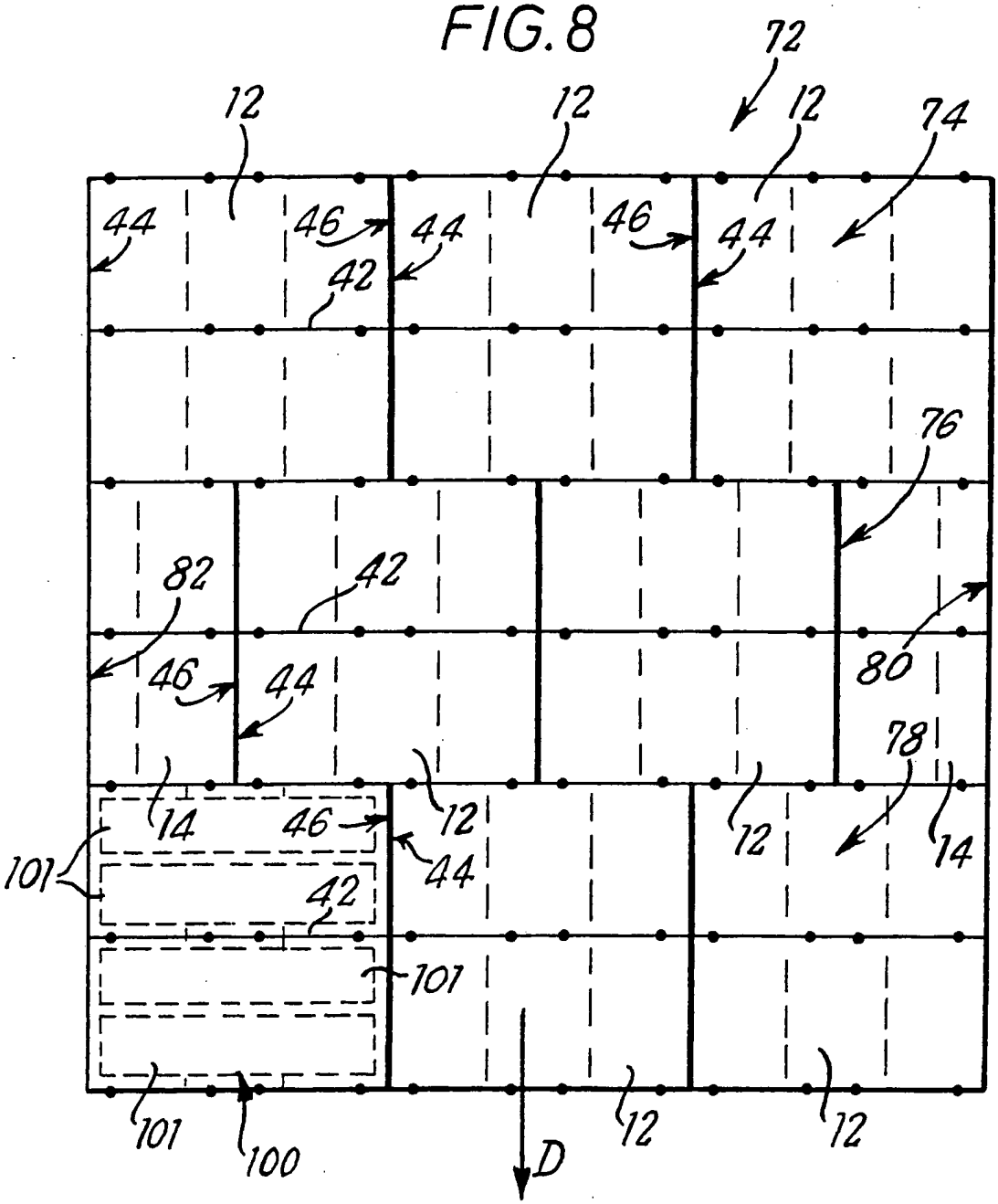




FIG. 6

FIG. 5

FIG. 8



SPECIFICATION

## Improvements in or relating to screens

This invention relates to screens, and in particular, though not exclusively, to screens suitable for separating and grading according to particle size, particulate material such as rocks, chemicals, mineral ores or the like.

Such a screen comprises a support frame having mounted thereon a screen mat formed with an array of apertures of appropriate size for grading particulate material. The screen mat may be of steel plate, woven wire, rubber, polyurethane elastomer or other polymer, or any other suitable material. In use, the support frame and the associated screen mat is vibrated or rotated continuously or intermittently in a plane which may be vertical, horizontal or at any suitable attitude therebetween, in order to promote the passage of material through the screen mat. Particles smaller than a size determined by the size of the apertures in the screen mat pass therethrough, while larger particles are retained on the screen mat.

In our UK patent specification 1,414,303 we have disclosed a screen mat comprising a moulded elastomeric body having embedded therein inextendable tensioning members for controlling the vibration characteristics of the screen mat while retaining the excellent wear characteristics of such elastomeric materials as polyurethane.

We have found that in order to provide maximum control of the vibration characteristics of a moulded elastomeric screen mat as disclosed in our above-mentioned UK patent specification, it is desirable that the support frame for the screen mat should be slightly raised in its central region, whereby the tensioning members positively hold the screen mat against this raised central region. However, the result of the provision of a raised central region in the screen mat is that material being screened tends to flow away from this central region and towards the side edges of the screen, whereby the efficiency of the screen as a whole is somewhat reduced.

A further operating characteristic of previously proposed screens is that when damage occurs to some part of the screen mat it is necessary to replace the whole screen mat, which is expensive and inconvenient to the operator, and represents another design area where improvements are desirable.

An object of this aspect of the present invention is to provide a screen offering improvements in relation to one or more of the problems identified above.

According to a first aspect of the present invention there is provided a screen comprising a support frame and a series of screen mat elements to be mounted on the support frame, the screen mat elements being adapted to be mounted on the frame in edge-to-edge relationship so as to provide a screening surface.

Preferably, the screen mat elements are formed of polymeric material. The polymeric material may have embedded therein rigid or semi rigid stiffening [illegible] of a sub-frame. The

Fastening means may be provided to secure the screen mat elements to the support frame. The fastening means may comprise fasteners co-operating with apertures formed in the screen mat elements and in the support frame. The fasteners may comprise an outer sleeve member for insertion into said apertures, and an inner fastening member for insertion into the sleeve member to expand the sleeve member. The apertures formed in said screen mat elements may include apertures formed at one or more edges of the screen mat elements, whereby a single fastener may co-operate with two adjacent screen mat elements to secure said screen mat elements to the support frame. The fasteners are preferably formed of polyurethane or other suitable polymeric material.

The provision of a screen comprising a series of screen mat elements as defined above and providing a screening surface enables the use of a flat support frame therefor whereby a central raised region of the screen mat is avoided. Likewise, the provision of a screen mat made up of screen mat elements enables one or more of the screen mat elements to be readily replaced after damage has occurred, while the remainder of the screen mat is left intact.

However, the provision of a screen mat in the form of a series of screen mat elements raises certain problems in relation to the provision of adequate support for the screen mat elements, and in relation to the provision of an adequate screening area in the screen mat as a whole. These problems are to some extent inter-related.

In order to support the screen mat elements, it is necessary to provide the support frame with frame members extending across the width and/or length of the frame to support the individual screen mat elements. In the regions where the screen mat elements rest on the frame members, the screen mat elements are preferably not formed with apertures since in these regions no screening can be effected and, from the strength point of view, it is preferably to provide the screen mat elements with unapertured reinforcing ribs in those regions. It will therefore be appreciated that the provision of a screen mat comprising a series of screen mat elements raises the problem that the non-screening areas of the whole screen mat need to be kept to an absolute minimum, and it is an object of this aspect of the invention to provide means whereby the non-screening regions of the screen mat elements can be minimised.

In a screen comprising screen mat elements formed of polymeric material having embedded therein stiffening means, as defined above, the screen mat elements are inherently stiffer than otherwise and require less support from the support frame, whereby the non-screening regions of the screen mat elements can be minimised.

A further factor in relation to the operational efficiency of a screen mat comprising screen mat elements, is the desirability to avoid the provision of linear non-screening zones extending lengthwise of the screen mat. Such non-screening zones have, in the past, been present in the edge regions of known

screen mat elements, there is the possibility that such non-screening zones may extend lengthwise of the screen mat along the edge regions of the screen mat elements or, indeed, along the non-apertured rib regions of successive screen mat elements.

It is an object of this aspect of the present invention to provide improvements in relation to the avoidance or minimisation of linear non-screening regions in a screen mat.

According to a second aspect of the present invention there is provided a screen comprising a support frame and a series of screen mat elements to be mounted on the support frame, the screen mat elements being adapted to be mounted on the support frame in edge-to-edge relationship, wherein the edge region of at least one of said screen mat elements is formed with screening apertures.

Said screen mat element formed with screening apertures in its edge region may comprise one portion of a screen mat element divided into two or more such portions. Preferably, said screen mat element to be divided is formed with an odd number of screening zones separated by non-screening zones, and is divided through one of said screening zones into two equal portions.

According to another aspect of the present invention there is provided a screen comprising a support frame and a series of screen mat elements to be mounted on the support frame, the screen mat elements being adapted to be mounted on the support frame in edge-to-edge relationship so as to provide a screening surface, at least some of the screen mat elements having non-screening zones in their edge regions, wherein said screen mat elements are of at least two different sizes and are arranged so that at least some of their non-screening edge regions are staggered with respect to the corresponding edge regions of adjacent screen mat elements.

A further factor in relation to the provision of a screen mat comprising a series of screen mat elements, relates to the requirement by screen operators for a screen presenting to material passing over the screen, a succession of different aperture sizes so as to progressively screen and separate particles corresponding in size to these apertures.

In principle, the provision of such a screen appears to be relatively straightforward. However, in order for a screen to be effective in operation and not to be subject to jamming or "blinding" of particles in the apertures of the screen, it is necessary for the thickness of the material of the screen mat to correspond to the size of the aperatures formed therein.

Consequently, the problem arises that, in the case of a screen mat comprising screen mat elements, the substitution of some screen mat elements for others in the screen mat, so as to change the aperture sizes, would be expected to produce a step up or a step down in the upper surface of the screen mat over which the material to be screened is passed. Clearly, such a step up or step down will seriously interfere with the operational efficiency of the screen as a whole and it is an object of this aspect of the present problem.

According to this aspect of the present invention there is provided a screen comprising a support frame and a series of screen mat elements to be mounted on the support frame, the screen mat elements being adapted to be mounted on the support frame in edge-to-edge relationship so as to provide a screening surface, wherein at least some of said screen mat elements are formed with screening apertures of one size and others of said screen mat elements are formed with apertures of another size, the thickness of the material of said screen mat elements in their apertured regions being greater in the case of the screen mat elements having the larger apertures, and the overall thickness of said screen mat elements measured between their support frame-contacting lower surfaces and their upper screening surfaces being substantially constant.

Preferably the thickness of the material of the apertured region of the screen mat elements is less than the width or diameter of the apertures therein.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings of which:-

*Figure 1* shows a perspective view of a support frame for supporting an series of screen mat elements. In this view, the support frame is seen from above and to one side, and part of the support frame is cut away at each end;

*Figure 2* shows a cross section on the line II-II in Figure 1 through the support frame showing a screen mat element supported on frame members of the support frame;

*Figure 3* shows a plan view of the upper-side of a screen mat element to be mounted on the support frame of Figures 1 and 2;

*Figure 4* shows a perspective view from one end, of the under side of the screen mat element of Figure 3;

*Figure 5* shows a perspective view from one end, of the upper side of the screen mat element of Figures 3 and 4;

*Figure 6* shows, in a view similar to that of Figure 5, a screen mat element having an edge region formed with screening apertures, this screen mat element being formed by dividing in half the screen mat element of Figure 5;

*Figure 7* shows, on a larger scale, a portion of Figure 2 showing a fastener securing a screen mat element to a frame member of the support frame of Figures 1 and 2, and

*Figure 8* shows an arrangement of the screen mat elements assembled on a support frame.

Figure 1 shows a support frame 10 to support a series of screen mat elements 12, 14 (see Figures 3 to 6) and thereby form a screen for separating and grading according to particle size, such materials as rocks, chemicals, mineral ores and the like.

Support frame 10 is mounted in apparatus (not shown) whereby it is vibrated or oscillated in any suitable manner so as to promote the passage through the apertures provided in the screen mat elements, of particles of material being screened.

Material to be screened is caused to pass over the

while separation proceeds.

Support frame 10 is generally rectangular in form and comprises a set of seven transverse frame members 22 formed of channel section steel and two longitudinal frame members 24 welded to the transverse frame members, and two side frame members 26 welded one to each of the ends of the transverse frame members 22. Upright end plates 28 are welded to the two end transverse frame members 22, to locate the screen mat elements. Likewise, two upright side plates 30 are welded, one to each of the side frame members 26. The transverse frame members 22 are each formed with a series of apertures 32 to receive fasteners 34 (see Figure 7) to be described below and for securing the screen mat elements thereto.

Figures 3, 4, 5 and 6 show the structure of the screen mat elements 12 and 14, which are mounted on the support frame 10 of Figures 1 and 2. Screen mat elements 12 will be described first.

Each screen mat element 12 is a moulded article of polyurethane elastomer having embedded therein stiffening means in the form of a rigid or semi rigid sub-frame having sub frame members 36 (see Figure 7).

The length and breadth of each screen mat element 12 is 600 millimetres, and the element is provided with a uniform flat upper screening surface 38 divided up into 12 screening zones 40, the 12 screening zones being divided by a central rib 42 into two groups of three pairs of screening zones.

Central rib 42 has no screening apertures formed therein (although it has apertures which receive the fasteners 34) and thus is a non-screening zone. The screen mat element is likewise provided with similar (though narrower) side ribs 44, 46, and similar end ribs 48 and 50. One narrow transverse support rib 52 and two narrow longitudinal support ribs 54 divide each of the two main screening zones into their respective three pairs of screening zones 40.

All the ribs 42 to 54 are of solid, non-apertured polyurethane with steel bar reinforcement. The latter reinforcement is preferably in the form of a lattice sub-frame which extends throughout all of the ribs. In the case of the central rib 42 and the side ribs 44 and 46, steel sub frame members 36 (see Figure 7) are embedded therein to co-operate with fasteners 34.

The under-side surfaces of ribs 42 to 54 rest on the upper surfaces of transverse frame members 22 so as to support the screen mat element. The upper screening surface 38 of the screen mat element is substantially flat. The screening zones 40 lying between the ribs 42 to 54 are, as seen in Figure 4, substantially recessed at the under side of the screen mat element so that the screening apertures 56 themselves are formed in polyurethane which is substantially less thick than the ribs 42 to 54. The size of the screening apertures 56 is selected according to requirements. The thickness of the polyurethane in the screening zones 40 themselves is chosen so as to be at least slightly less than the width (or diameter) of the screening apertures themselves. Thus, regardless of the screening aperture size on screening surface 38 with respect to the transverse frame members 22 supporting the screen mat is constant.

The screening mat elements 12 and 14 are secured to the transverse frame members 22 by means of fasteners 34 which pass through apertures 58 formed in central rib 42 and apertures 60 formed in end ribs 48 and 50. All three such ribs have embedded therein the steel sub frame members 36, which are likewise apertured.

The apertures 58 in central rib 42 are cylindrical in form and define a substantial recess for each fastener 34 whereby the latter is protected to some extent from abrasion during screening operations. The apertures 60 in the end ribs 48 and 50 are each semi-cylindrical in form and arranged so that in use, two such apertures co-operate to define a a cylindrical aperture very similar to the apertures 58, whereby a single fastener 34 co-operates with the side edges of two adjacent screen mat elements, securing the latter to the transverse frame members 22.

Figure 7 shows a fastener 34 co-operating with a screen mat element 12 and one of the transverse frame members 22. Each fastener is formed of polyurethane and comprises an outer sleeve member 62 having a tapered bore which converges as it recedes from a collar or flange 66. The member 62 is inserted into the aligned apertures 32 and 58, together with an inner fastening member 64 which is inserted into the outer sleeve member to deform the latter outwardly. The flange or collar 66 rests on the bottom of aperture 58 and against the upper surface of sub frame member 36. At its lower end the outer sleeve member has an outwardly deformable end portion 68 which is deformed outwards by the inner fastening member 64 so as to co-operate with the inner surface of transverse frame member 22.

The structure of screen mat elements 14 is shown in Figure 6, and it suffices to say that the screen mat elements 14 are formed by dividing screen mat elements 12 centrally parallel to and between the longitudinal support ribs 54. Thus each screen mat element 14 is identical in structure to one half of a screen mat element 12. It is to be noted that one longitudinally extending edge 70 of each screen mat element 14 is formed with screening apertures 58 - for a purpose to be described below with reference to Figure 8.

Figure 8 shows the arrangement of screen mat elements 12 and 14 when assembled on the support frame 10. The screen mat elements are arranged edge-to-edge so as to provide a smooth screening surface. The direction of flow of material to be screened over the screen is indicated by arrow D. The opposite direction of flow could be used if desired.

The screen 72 as a whole comprises three rows 74, 76 and 78 of screen mat elements arranged with their central ribs 42 extending laterally with respect to direction D. The two end rows 74 and 78 each comprise three screen mat elements 12, whereas the central row 76 comprises two central screen mat elements 12 and two screen mat elements 14, one at each end.

screened passing in direction D along the side edges 80 and 82 of screen 72 is obliged to pass over the apertured edge region of the centrally-disposed screen mat elements 14 and is thereby subjected to screening action. Likewise, by virtue of the staggered relationship of the side ribs 44 and 46 of the screen mat elements 12 and 14, material to be screened which passes over the screen purely in direction D is obliged to encounter several screening zones 40 and none of this material is able to pass over the screen without being subjected to the necessary screening action.

The screen shown in Figure 8, as above described, is constructed from identical modular screen mat elements which (at least initially in the case of the half elements in the row 76) are of the form as shown in Figure 5. From Figure 5 it will be seen that the mat element is symmetrical about lateral and longitudinally extending centre lines and, in effect, has four laterally extending rows with three apertured discrete screening areas in each row. An odd number of such discrete screening areas in each laterally extending row is preferred to ensure that the staggered array of discrete screening areas is maintained between longitudinally adjacent mat elements on the screen as previously described. It will be appreciated that the odd number of discrete screening areas as aforementioned can be varied from three and, for convenience, there is indicated at 100 in Figure 8 a screen mat element having four laterally extending rows with one discrete screening area 101 in each row, thus minimising the unapertured screening area and thereby maximising the screening efficiency.

The principal advantages of the embodiment of of the invention described above include the modular form of the screen mat itself, whereby individual screen mat elements can be replaced if damaged, or if a change in screen aperture size is desired. The screen mat elements are securely fastened onto the support frame in a simple manner and are easily detachable. A raised central region is avoided, whereby uniform flow of material over the whole screen is achieved. By adoption of a constant overall screen mat element thickness, regardless of aperture size, a smooth screening surface is provided regardless of the interchange of screening elements. Screening efficiency is increased by avoidance of totally unapertured edge regions of the screen and by the staggered relationship of the end portions of the screen mat elements. The use of a rigid or semi rigid sub frame embedded in the screen mat elements enables the use of a larger than otherwise possible apertured area in each such element.

Among modifications which could be made in the above embodiment are variations in the disposition and spacing of the support frame members, variations in the shape and dimensions of screen mat elements and of the disposition and size of the screening zones therein. The relative sizes of the screen mat elements 12 and 14 can, of course, be varied and numerous variations are possible in the arrangement of the non-apertured rib regions of the screen mat elements.

that it is symmetrical about a centre line and rows of screening apertures are located immediately adjacent to and along each side of that centre line so that if the element is cut into two equal portions along the said centre line the marginal edge regions of the resultant edges are apertured. This is advantageous when the half portions of the screening element are used for the purposes of staggering adjacent rows of such elements in the support frame.

CLAIMS (Filed 12 Jan 1982)

1. A screen comprising a support frame and a series of screen mat elements to be mounted on the support frame, the screen mat elements being adapted to be mounted on the frame in edge-in-edge relationship so as to provide a screening surface.

2. A screen according to claim 1 wherein said screen mat elements are formed of polymeric material.

3. A screen according to claim 2 wherein said polymeric material has embedded therein rigid or semi-rigid stiffening means in the form of a subframe.

4. A screen according to claim 2 or claim 3 wherein said polymeric material comprises polyurethane.

5. A screen according to any preceding claim comprising fastening means adapted to secure said screen mat elements to the support frame.

6. A screen according to claim 5 wherein said fastening means comprises fasteners co-operating with apertures formed in said screen mat elements and in said support frame.

7. A screen according to claim 6 wherein said fasteners each comprises an outer sleeve member for insertion into said apertures, and an inner fastening member for insertion into the sleeve member to expand the sleeve member.

8. A screen according to any one of claims 6 or claim 7 wherein said apertures formed in said screen mat elements include apertures formed at one or more edges of the screen mat elements, whereby a single fastener may co-operate with two adjacent screen mat elements to secure said screen mat elements to the support frame.

9. A screen according to any one of claims 6 to 8 wherein said fasteners are formed of polyurethane.

10. A screen constructed and arranged substantially as described herein with reference to the accompanying drawings.

11. A screen comprising a support frame and a series of screen mat elements to be mounted on the support frame, the screen mat elements being adapted to be mounted on the support frame in edge-to-edge relationship, wherein the edge region of at least one of said screen mat elements is formed with screeing apertures.

12. A screen according to claim 11 wherein said screen mat element formed with screening apertures in its edge region is formed by dividing a larger screen mat element into two or more portions.

13. A screen according to claim 12 wherein said larger screen mat element is formed with an odd

screening zones, and is divided through one of said screening zones into two equal portions.

14. A screen according to claim 11 substantially as described herein with reference to the accompanying drawings.

15. A screen comprising a screen mat element substantially as described herein with reference to Figure 6 of the accompanying drawings.

16. A screen comprising a support frame and a series of screen mat elements to be mounted on the support frame, the screen mat elements being adapted to be mounted on the support frame in edge-to-edge relationship so as to provide a screening surface, at least some of the screen mat elements having non-screening zones in their edge regions, wherein said screen mat elements are of at least two different sizes and are arranged so that at least some of their non-screening edge regions are staggered with respect to the corresponding edge regions of adjacent screen mat elements.

17. A screen comprising a support frame and a series of screen mat elements to be mounted on the support frame, the screen mat elements being adapted to be mounted on the support frame in edge-to-edge relationship so as to provide a screening surface, wherein at least some of said screen mat elements are formed with screening apertures of one size and others of said screen mat elements are formed with apertures of another size, the thickness of the material of said screen mat elements in their apertured regions being greater in the case of the screen mat elements having said larger apertures, and the overall thickness of said screen mat elements between their support frame-contacting lower surfaces and their upper screening surfaces being substantially constant.

18. A screen according to claim 17 wherein the thickness of the material of said apertured region of said screen mat elements is not greater than the width or diameter of said apertures therein.

19. A screen as claimed in any one of the preceding claims in which the screen mat elements comprise ribs by which said elements sit on supporting frame members of the support frame, said screen mat elements being secured by fastening means to the frame members solely through said ribs.

20. A screen as claimed in any one of the preceding claims in which the screen mat elements are carried by the support frame which is of substantially rectangular configuration comprising edge members and a parallel array of frame members extending between said edge members on which frame members the screen mat elements sit for support.

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